Wherefore, what is claimed is:

1. A computer-implemented process for generating a representation of an object, comprising using a computer to perform the following process actions:

for a prescribed number of directions,

determining the thickness of the object along each of a prescribed number of parallel rays directed through the object in the direction under consideration,

normalizing the determined thickness values, and

generating a thickness histogram from the normalized values;

wherein the thickness histograms associated with the prescribed directions define a directional histogram model of the object which is employed as a representation of the object that is substantially invariant in regard to translation and scaling.

2. The process of Claim 1, wherein the process action of determining the thickness of the object for a prescribed parallel ray directed through the object, comprises actions of:

identifying the 3D coordinates of the nearest point of intersection of the ray with the object;

identifying the 3D coordinates of the furthest point of intersection of the ray with the object;

computed the distance between the 3D coordinates of the nearest point of intersection and the furthest point of intersection, wherein the computed distance represents the thickness of the object as transected by the ray.

3. The process of Claim 1, wherein the process action of determining the thickness of the object for a prescribed parallel ray directed through the object, comprises actions of:

rendering an image of the front of the object using a 3D graphics accelerator and reading the depth value corresponding to each pixel of the object's front;

rendering an image of the back of the object using the 3D graphics accelerator and reading the depth value corresponding to each pixel of the object's back;

computing the distance between the depth values associated with a pair of corresponding pixels for each pair of corresponding pixels of the images of the front and back of the object, wherein the computed distance represents the thickness of the object as would be transected by a parallel ray directed through the corresponding pixels from the direction under consideration.

4. The process of Claim 1, wherein the process action of normalizing the thickness values, comprises an action of dividing each of the values by the maximum thickness value.

5. The process of Claim 1, further comprising the process action of uniformly quantizing the thickness values after they have been normalized.

6. The process of Claim 5, wherein the thickness values are quantized into 64 integer values.

7. The process of Claim 1, wherein the directions are equally spaced from each other around the object being modeled.

8. The process of Claim 7, wherein for each of the directions, its opposite direction is not included in the group of directions considered, thereby preventing the generation of redundant thickness histograms.

9. The process of Claim 8, wherein the prescribed number of directions is chosen to be large enough to ensure that the directional histogram

model of an object distinguishes that object from dissimilar objects to an acceptable degree, while at the same time being small enough to allow the directional histogram model to be generated in an acceptable amount of time.

10. The process of Claim 9, wherein the prescribed number of directions is 256.

11. The process of Claim 1, wherein the object is a 2 dimensional object.

12. The process of Claim 1, wherein the object is a 3 dimensional object.

13. A system for generating a directional histogram model of an object from a geometric model of the object, comprising:

a general purpose computing device comprising a 3D video graphics accelerator; and

a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to,

(a) select a previously unselected sampling direction from a set of sampling directions,

(b) generate an orthogonal projection of the object from the geometric model thereof for the selected sampling direction,

(c) render an image of the front of the object associated with projection using the graphics accelerator and read the depth value corresponding to each pixel of the object's front,

(c) render an image of the back of the object associated with projection using the graphics accelerator and read the depth value corresponding to each pixel of the object's back,

(d) select a previously unselected pair of corresponding pixels of the images of the front and back of the object,

(e) compute the distance between the depth values associated with the currently selected pair of corresponding pixels,

(f) repeat program modules (d) and (e) for all the remaining previously unselected pairs of corresponding pixels of the object images,

(g) normalize the computed distance values,

(h) construct a thickness histogram for the selected sampling direction using the normalized distance values,

(i) repeat program modules (a) through (h) for all the remaining previously unselected sampling directions,

(j) designate the thickness histograms constructed for the selected sampling directions as a directional histogram model of the object.

14. The system of Claim 13, further comprising a program module for uniformly quantizing the thickness values after they have been normalized.

15. The system of Claim 13, wherein the images of the front and back of the object have a prescribed window size dictating the number of pixels present in the images, and wherein the window size is chosen to be small enough so as to maintain an acceptable rendering speed and depth value lookup, while at the same time large enough to ensure an acceptably accurate thickness distribution.

16. The system of Claim 15, wherein the window size is 128 by 128 pixels.

17. The system of Claim 13, further comprising, prior to executing the program module for generating an orthogonal projection of the object from the geometric model thereof, executing a program module for simplifying the

geometric model of the object to a degree which will simplify the subsequent processing while still resulting in a directional histogram model of an object that distinguishes that object from dissimilar objects to an acceptable degree.

18. A computer-implemented process for measuring the similarity between geometric models of objects using a representation of the objects, comprising using a computer to perform the following process actions:

for each object and a prescribed number of directions,

determining the thickness of the object along each of a prescribed number of parallel rays directed through the object in the direction under consideration,

normalizing the determined thickness values,

generating a thickness histogram from the normalized values;

normalizing the thickness histogram;

designating the normalized thickness histograms associated with the prescribed directions as a directional histogram model of the object;

characterizing the directional histogram model as a number of spherical functions defined on a unit sphere;

performing a spherical harmonic transform of the characterized histogram model to produce a matrix descriptor which is employed as a representation of the object that is substantially invariant in regard to translation, scaling, and rotation; and

computing a distance measurement between the matrix descriptors of the objects being measured for similarity, wherein the distance measurement is indicative of the degree of difference between the matrix descriptors of the objects.

19. The process of Claim 18, further comprising a process action of determining whether an object is similar to one or more other objects, wherein said determining action comprises:

creating a database of objects each of which is characterized as a matrix descriptor;

inputting a geometric model of a sample object and generating a matrix descriptor of the object;

computing a distance measurement between the matrix descriptor of the sample object and each of the matrix descriptors in the database, wherein the distance measurement is indicative of the degree of difference between the matrix descriptors of each compared pair;

identifying objects characterized in the database that are similar to the sample object based on their respective distance measurements; and

designating the identified objects as being similar to the sample object.

20. The process of Claim 19, wherein the process action of identifying objects characterized in the database that are similar to the sample object, comprises an action of identifying a prescribed number of the objects characterized in the database that are associated with the lowest distance measurements.

21. The process of Claim 19 wherein the process action of identifying objects characterized in the database that are similar to the sample object, comprises an action of identifying objects whose associated difference measurement falls below a difference threshold;

22. The process of Claim 18, further comprising a process action of determining whether two objects are similar, wherein said determining action comprises:

ascertaining whether the difference measurements computed for the two objects falls below a difference threshold; and

whenever the difference measurements fall below said threshold, designating the objects as being similar to each other.

23. The process of Claim 18, wherein the process action of computing a distance measurement between the matrix descriptors of the objects being measured for similarity, comprises an action of computing the norm of the difference between the matrix descriptors of each pair of objects being measured.

24. A computer-readable medium having computer-executable instructions for measuring the similarity between geometric models of objects using directional histogram models of the objects, said computer-executable instructions comprising:

generating a directional histogram model representation of each object from the geometric model of the object, wherein generating the directional histogram model for an object comprises, for each of a prescribed number of directions,

determining the thickness of the object along each of a prescribed number of parallel rays directed through the object in the direction under consideration,

normalizing the determined thickness values,

generating a thickness histogram from the normalized values,

and wherein the thickness histograms associated with the prescribed directions are designated as the directional histogram model representing the object being modeled; and

computing a distance measurement between the directional histogram models of the objects being measured for similarity, wherein the distance measurement is indicative of the degree of difference between the directional histogram models of the objects.

25. The computer-readable medium of Claim 24, further comprising an instruction for determining whether two objects are similar, said determining comprising:

ascertaining whether the difference measurements computed for the two objects falls below a difference threshold; and

whenever the difference measurements fall below said threshold, designating the objects as being similar to each other.

26. The computer-readable medium of Claim 24, further comprising an instruction for determining whether an object is similar to one or more other objects, said determining comprising:

creating a database of objects each of which is characterized as a directional histogram model;

inputting a geometric model of a sample object and generating a directional histogram model of the object;

computing a distance measurement between the directional histogram model of the sample object and each of the directional histogram models in the database, where the distance measurement is indicative of the degree of difference between the directional histogram models of each compared pair;

identifying a prescribed number of the objects characterized in the database that are associated with the lowest distance measurements;

designating the identified objects as being similar to the sample object.

27. The computer-readable medium of Claim 24, further comprising an instruction for determining whether an object is similar to one or more other objects, said determining comprising:

creating a database of objects each of which is characterized as a directional histogram model;

inputting a geometric model of a sample object and generating a directional histogram model of the object;

computing a distance measurement between the directional histogram model of the sample object and each of the directional histogram models in the database, where the distance measurement is indicative of the degree of difference between the directional histogram models of each compared pair;

identifying objects characterized in the database whose associated difference measurement falls below a difference threshold;

designating the identified objects as being similar to the sample object.